# COSEWIC
# Assessment and Status Report

on the

# Ermine *haidarum* subspecies
## *Mustela erminea haidarum*

in Canada

**THREATENED**
**2015**

**COSEWIC**
Committee on the Status
of Endangered Wildlife
in Canada

**COSEPAC**
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Ermine *haidarum* subspecies — Source: Janet Gifford.

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# COSEWIC
# Assessment Summary

**Assessment Summary – May 2015**

**Common name**
Ermine *haidarum* subspecies

**Scientific name**
*Mustela erminea haidarum*

**Status**
Threatened

**Reason for designation**
This genetically distinct subspecies of Ermine is known only from Haida Gwaii. The species appears to have declined to small population size due to habitat changes associated with the introduction of Black-tailed Deer, and possible competition for food with an increasing population of Pacific Marten. A comparison of results of recent, intensive sampling efforts with historical trapping records suggests a decline in numbers, and that the population is expected to continue to decline due to ongoing threats.

**Occurrence**
British Columbia

**Status history**
Designated Special Concern in April 1984. Status re-examined and designated Threatened in May 2001 and May 2015.

**COSEWIC**
**Executive Summary**

# Ermine *haidarum* subspecies
*Mustela erminea haidarum*

## Wildlife Species Description and Significance

The Ermine, *haidarum* subspecies (*Mustela erminea haidarum*, hereafter 'Haida Ermine') is a subspecies of Ermine (Short-tailed Weasel). It has a typical weasel form, with a small face, short, oval ears, and a slender, elongated body with a furred, black-tipped tail. The summer pelage changes from reddish-brown upperparts and creamy-white lower parts to white in winter. The subspecific status of Haida Ermine is based on unique morphometric characters and is supported by genetic analyses. The Haida Ermine has been isolated from the mainland for approximately 11,000 years and is significant as evidence of the existence of a glacial refugium in the north Pacific coast, and one of four genetic clades of Ermine worldwide.

## Distribution

Based on present taxonomy, the Haida Ermine occurs only on Haida Gwaii Archipelago (Queen Charlotte Islands), British Columbia. It is known definitely to occur on Graham, Moresby, Louise, and Burnaby Islands, though it likely occurs on other smaller islands in the Archipelago as well.

## Habitat

Haida Ermine records have occurred from sea level to 800 m asl, but most records exist below 350 m in coniferous forest of the Submontane Wet Hypermaritime biogeoclimatic zone. The Haida Ermine may be rarer in western, higher elevation and wetter locations on Haida Gwaii.

## Biology

Relatively little is known about the biology of the Haida Ermine. Based on Ermine biology on the mainland, which should be similar among subspecies, Haida Ermine likely breed in the summer/autumn, and have one litter of 4 - 6 kits the following spring. The lifespan of most individuals is less than two years. Haida Ermine are opportunistic predators that rely on small mammals, birds, and invertebrates, and scavenge on Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*).

**Population Sizes and Trends**

Surveys confirm that Haida Ermine are very rare on Haida Gwaii. Intensive surveys have been conducted to locate the species but since the mid-1990s have yielded fewer than 40 verified (or probable) records. Population estimate is unknown, but based on available data the population size likely is fewer than 1000 mature individuals. A historical population decline since the 1950s is inferred based on decreased capture success and future declines are predicted because of ongoing threats.

**Threats and Limiting Factors**

Historically, Haida Ermine likely had a naturally low population size because of a limited prey base, and are likely to decline in the future due to various threats. The main threats to the Haida Ermine are habitat changes from increased competition and predation associated with various wildlife species introductions on Haida Gwaii. Introduced Deer have severely reduced understorey vegetation in much of the known Haida Ermine range, which has likely increased mortality rates from predators, and reduced populations of preferred prey species for Haida Ermine. The native Pacific Marten (*Martes caurina*) population has increased, likely from the introduction of Deer (a source of carrion) and Red Squirrel (*Tamiasciurus hudsonicus*). Pacific Marten compete with Haida Ermine for the limited food base, and also may be a predation threat. Unlike Pacific Marten, Haida Ermine likely do not benefit from the introduction of Red Squirrel and rats.

Haida Ermine are trapped accidentally in traps set for Pacific Marten. The low Haida Ermine population may be impacted by trapping but the threat is difficult to quantify because trap effort is unknown. Rat eradication programs on several islands in Gwaii Haanas National Park Reserve likely have not impacted Haida Ermine.

**Protection, Status, and Ranks**

The rounded global Nature Serve rank is G5T2 (imperilled) for Haida Ermine. It has a national rank of N2 (nationally imperilled). Haida Ermine were assessed in 2001 as Threatened under the *Species at Risk Act*. Provincially, Haida Ermine is ranked as an S2 species (Imperilled), is on the provincial Red List, and is a candidate for endangered or threatened status in British Columbia.

Intentional trapping of Haida Ermine has not been permitted since 1985. Approximately half of the islands where Haida Ermine have been recorded are protected by national and provincial protected areas but their value to Haida Ermine is unclear because threats are related to introduced species, and accidental mortality from trapping Pacific Marten, rather than forest harvest. Pacific Marten trapping is permitted in provincial and national protected areas, but is presently inactive within Gwaii Haanas National Park Reserve.

## TECHNICAL SUMMARY

*Mustela erminea haidarum*

Ermine *haidarum* subspecies Hermine de la sous-espèce *haidarum*

Range of occurrence in Canada: Haida Gwaii, British Columbia

**Demographic Information**

| | |
|---|---|
| Generation time; Calculated as [1/estimated annual adult mortality rate] + estimated age of first reproduction).<br><br>The provided range incorporates highly variable 1st year mortality rates recorded in studies on Ermine elsewhere. | 2 to 3 years |
| Is there an inferred and projected continuing decline in number of mature individuals?<br><br>Declines likely to continue because impact of Deer over-browsing increases over time, and Deer populations are likely to persist. Competition with Pacific Marten for food expected to continue. | Yes |
| Estimated percent of continuing decline in total number of mature individuals within 4 - 6 years. | Unknown |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years. | Unknown |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next 10 years]. | Unknown |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any 10-year period, over a time period including both the past and the future. | Unknown |
| Are the causes of the decline clearly reversible and understood and ceased?<br><br>Declines likely to continue because impact of Deer over-browsing increases over time, and Deer populations are likely to persist. Competition with Pacific Marten for food is expected to continue. | No |
| Are there extreme fluctuations in number of mature individuals? | Unknown |

**Extent and Occupancy Information**

| | |
|---|---|
| Estimated extent of occurrence | 10,816 km² |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value).<br><br>Based on all records. If historical (<1990) museum records are omitted, the IAO is 1,032 km² | 1,052 km² |
| Is the population severely fragmented?<br><br>Movement between islands likely varies depends on distance of permanent water. | Unknown |

| | |
|---|---|
| Number of locations<br><br>Species is confirmed on four islands but probably occurs on more. Number of locations is dependent on distance between islands and (unknown) likelihood of movement between islands. The large size of two of the islands, and variation in threats within islands likely means there are numerous locations. | Many |
| Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? | Unknown |
| Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy? | Unknown |
| Is there an inferred and projected continuing decline in number of sub-populations?<br><br>The risk of local decline from numerous threats exists because of small population size but the impact on potential subpopulations is unknown. | Possibly |
| Is there an inferred and projected continuing decline in number of locations?<br><br>The risk of local decline from numerous threats exists because of small population size. | Possibly |
| Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?<br><br>Deer over-browsing continues and reduces dense understorey vegetation associated with food and security from predators. | Yes |
| Are there extreme fluctuations in number of populations? | Unlikely |
| Are there extreme fluctuations in number of locations? | Unlikely |
| Are there extreme fluctuations in extent of occurrence? | Unlikely |
| Are there extreme fluctuations in index of area of occupancy? | Unlikely |

**Number of Mature Individuals (in each population)**

| **Population** | **N Mature Individuals** |
|---|---|
| | |
| Total | Unknown |
| Population is unknown but extensive surveys have documented fewer than 40 animals in last 20 years; number of mature animals likely fewer than 1000. | |

**Quantitative Analysis**

| | |
|---|---|
| Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].<br><br>A PVA has not been conducted. | Unknown |

**Threats (actual or imminent, to populations or habitats)**

| |
|---|
| The main threats to Haida Ermine are: 1) interference competition for a limited food supply from an increasing Pacific Marten population that is supported by; 2) introduced Sitka Black-tailed Deer, which have removed much of the understory vegetation on Haida Gwaii, which in turn has reduced avian and rodent prey numbers and has likely made Haida Ermine more susceptible to predation; and 3) accidental mortality (by-catch) during Pacific Marten trapping could impact viability of Haida Ermine. |

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s)?<br><br>The Haida Ermine only occurs within Canada. | Not applicable |
| Is immigration known or possible? | No |
| Would immigrants be adapted to survive in Canada? | Not applicable |
| Is there sufficient habitat for immigrants in Canada? | Not applicable |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**COSEWIC Status History**

| |
|---|
| Designated Special Concern in April 1984. Status re-examined and designated Threatened in May 2001 and May 2015. |

**Status and Reasons for Designation:**

| | |
|---|---|
| **Status**:<br>Threatened | **Alpha-numeric code**:<br>C2a(i) |
| **Reasons for designation**:<br>This genetically distinct subspecies of Ermine is known only from Haida Gwaii. The species appears to have declined to small population size due to habitat changes associated with the introduction of Black-tailed Deer, and possible competition for food with an increasing population of Pacific Marten. A comparison of results of recent, intensive sampling efforts with historical trapping records suggests a decline in numbers, and that the population is expected to continue to decline due to ongoing threats. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Not Applicable. Population levels in last 10 years unknown. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not Applicable. Meets Threatened for EOO and IAO as well as inferred continuing decline in area, extent, and quality of habitat (sub-criterion b(iii)), but does not meet either sub-criteria a or c. |
| Criterion C (Small and Declining Number of Mature Individuals):<br>Meets Threatened C2a(i). Total number of mature individuals < 2500 with an inferred continuing decline, and no sub-population estimated to contain > 1000 mature individuals. |

| |
|---|
| Criterion D (Very Small or Restricted Population):<br>Might meet D1 Threatened but there is less certainty that total population is <1000 mature individuals, given that many areas have not been properly surveyed. |
| Criterion E (Quantitative Analysis):<br>Not Applicable. PVA not conducted. |

## PREFACE

The Ermine, *haidarum* subspecies (*Mustela erminea haidarum*) was assessed as Special Concern in April 1984, then assessed as Threatened in 2001 and eventually listed as Threatened under the *Species at Risk Act*. The designation of Threatened was based on its small population size and inferred decline. Since that time there has been considerable search effort to document the distribution and abundance of the species. The Ermine, *haidarum* subspecies (*Mustela erminea haidarum*) Recovery Strategy (2009; hereafter, 'Recovery 2009') was produced, with a federal supplementary report on critical habitat completed in 2011 (Parks Canada Agency 2011). The name, 'Haida Ermine' is used throughout the report; the name 'Ermine' refers to the other subspecies of Short-tailed Weasel.

## COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

## COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS
## (2015)

| | |
|---|---|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. |
| Not at Risk (NAR)** | A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

# COSEWIC Status Report

on the

# Ermine *haidarum* subspecies

*Mustela erminea haidarum*

**in Canada**

2015

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## WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

### Name and Classification

Common Name: Haida Ermine, Ermine, *haidarum* subspecies, Queen Charlotte Ermine, Short-tailed Weasel (English); Hermine de la sous-espèce *haidarum* (French); Tllga (Skidegate/Masset).

Class: Mammalia

Order: Carnivora

Family: Mustelidae

Genus: *Mustela*

Species: *erminea*

Subspecies: *haidarum* Preble (1898)

### Morphological Description

The Haida Ermine (*Mustela erminea haidarum*) is a small weasel with a long, slender body, black-tipped furred tail, and a small face with short oval ears (Figure 1). In summer, the upperparts are reddish-brown and lower parts creamy-white. In winter, their coat turns white.

Figure 1. Photograph of a captive Haida Ermine, in winter pelage, Sewall, Graham Island, 1981. Source: Janet Gifford.

The Haida Ermine is similar to other Ermine (Short-tailed Weasel; *Mustela erminea* Linnaeus 1758) but is described as the most morphologically distinctive Ermine subspecies due to the unique structural features of its skull (*i.e.*, relatively large pre-orbital region) and low sexual dimorphism (Hall 1951; Foster 1965; Cowan 1989; Reimchen and Byun 2005). A principal component analysis of 13 skull measurements from 76 North American male *M. erminea* identified Haida Ermine as distinct from other Ermine (Eger 1990). The Haida Ermine is a relatively small Ermine, with males (n = 3) ranging from 275 - 290 mm in length. By comparison, the length of the male Ermine subspecies on mainland British Columbia (*M. e. richardsonii;* n = 10), ranged from 301 - 367 mm (Cowan and Guiguet 1960). There also is less sexual dimorphism compared to other Ermine; Haida Ermine female skulls weigh only 29% less than males, compared to female skull weights being at least 42% less than males in other subspecies, and 52% in *M. e. richardsoni*, the most widespread Ermine subspecies found in Canada (Hall 1951; Foster 1965).

The Haida Ermine was originally classified as a separate species, *Putorius [Mustela] haidarum*, based on a unique morphology that was assumed to be related to its isolation from mainland populations (Preble 1898). Hall (1944, 1945) classified *haidarum* as a subspecies of *M. erminea* because the morphological differences found between island populations along the western coast would be insufficient to prevent breeding. In a major taxonomic review, Hall (1951) noted that Haida Ermine may warrant status as a full species, but retained Haida Ermine as one of 20 North American subspecies of Ermine, with seven of these subspecies located on coastal islands of British Columbia and Alaska.

The uniqueness of the Haida Ermine also has been established through genetic analyses. The Haida Ermine has been isolated from the continental and Beringial lineages of Ermine since the Wisconsin glaciation, which ended approximately 11,000 ybp (Byun 1999; Fleming and Cook 2002; Dawson *et al.* 2014). The highest elevation on Haida Gwaii presently is 1148 m asl and geological evidence suggests that land > 900 m asl was not glaciated (Banner *et al.* 2014). Other possible refugia have been identified for the Hecate Strait and Alexander Archipelago (Burles *et al.* 2004).

Fleming and Cook (2002) identified significant geographic variation in the mitochondrial cytochrome b gene of 210 *Mustela erminea* specimens from North America, Ireland, Russia, and Japan, and concluded that three lineages of Ermine exist, one of which, the 'island clade', is centred on *M. e. haidarum*, and two closely related subspecies from nearby Alaskan Islands: *M. e. celenda* on Prince of Wales Island, and *M. e. seclusa* on Suemez and Heceta Islands (Figure 2). A similar conclusion for three lineages worldwide was detected by Byun (1999). A more exhaustive assessment using the cytochrome b gene, the control region, and four independent nuclear loci on 237 *M. erminea* specimens worldwide (Haida Gwaii samples = 7; nearby Alaskan island samples = 8), recognized four clades (Island [= Haida Gwaii/Prince of Wales Island], Holarctic, Continental, Western), and reaffirmed the uniqueness of the island clade (Dawson *et al.* 2014).

The delineation of Ermine subspecies in western North America requires further research, but Haida Ermine presently are a recognized subspecies limited to Haida Gwaii (Hall 1981; King 1983; Wilson and Reeder 2005).

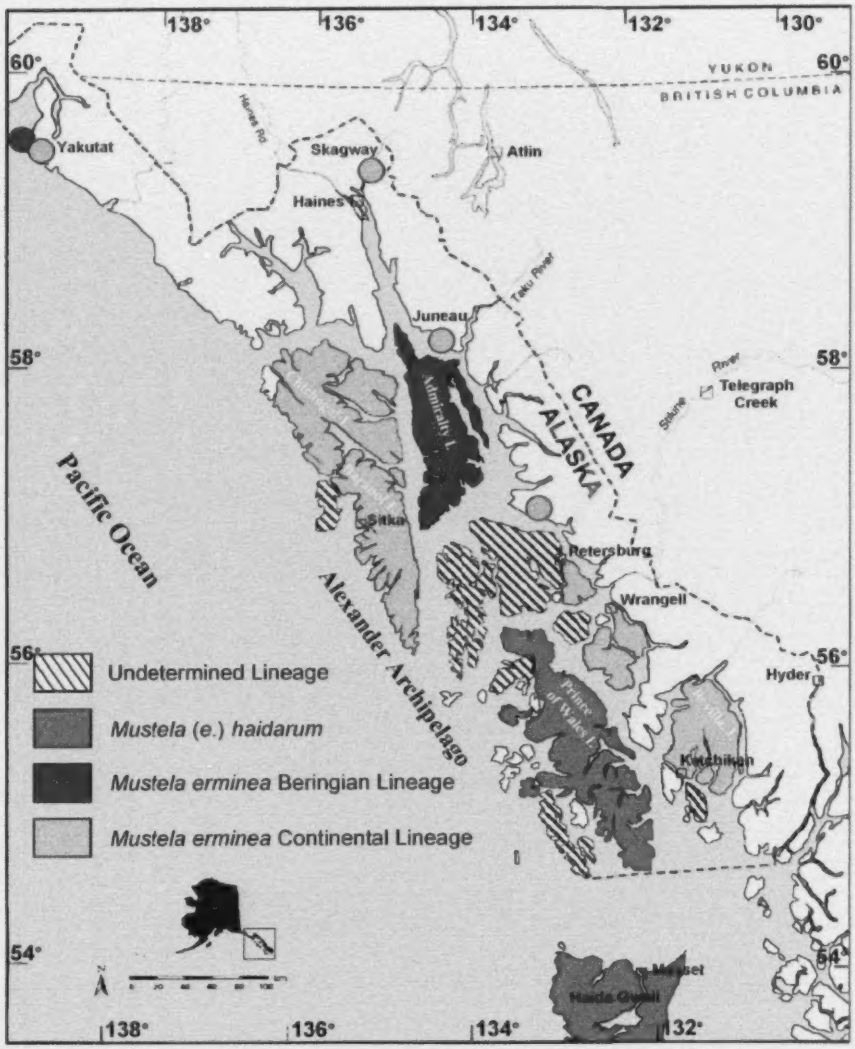


Figure 2. Location of the island clade of Ermine (*Mustela erminea*) on Haida Gwaii and Prince of Wales Island, shown in red. Three of four genetic clades (lineages) identified worldwide are found in the Haida Gwaii and Alexander Archipelago region (Flemming and Cook 2002; Dawson *et al.* 2014). Islands marked as undetermined lineage lack genetic samples. The figure is from Cook *et al.* (2006) and illustrates Ermine on Haida Gwaii and Prince of Wales as one subspecies but present taxonomy states that *M. e. haidarum* exist on Haida Gwaii, and *M. e. celenda* on Prince of Wales Island. Source: Cook *et al.* (2006).

## Population Spatial Structure and Variability

The genetic diversity of Ermine is discussed in the **Morphological Description**. The genetic diversity of the island clade (*M. e. haidarum, M. e. celenda, M. e. seclusa*) is considered to be low (Dawson *et al.* 2014). The spatial structure and genetic variability within the population of the Haida Ermine is unknown but likely is limited because they occur in a small area.

## Designatable Units

The Haida Ermine is considered one designatable unit within Canada because there is no evidence of genetic divisions among Haida Ermine.

## Special Significance

The Haida Ermine is one of only seven native land mammals extant in the Haida Gwaii Archipelago (Foster 1965; Nagorsen 1990, Reid *et al.* 1999, 2000). Many clans from the Haida First Nation have used Ermine in their crests (e.g., the Ninstints people of the Raven Clan, Stawaas xaad iagaii [Witch People], Naay yu aans xaada gaay [People of the Big House], Na saga xaada gaay [People of the Rotten House] and Qaay Ilnagaay [People of the Sea-lion town] of the Eagle Clan (Burles *et al.* 2004). The amount of contemporary ATK on Haida Ermine is sparse (Collison 2004 *in* Parks Canada Agency 2011). It is unknown if Ermine pelts in local ceremonial items were derived from trade with the mainland nations, or were Haida Ermine trapped on Haida Gwaii (Parks Canada Agency 2011).

The Haida Ermine is of special significance as a glacial-era relict from a unique lineage (Byun 1999; Fleming and Cook 2002). There are only four genetic clades of Ermine, even though Ermine are found across much of the northern hemisphere (see **Morphological Description**). Thus, all of Eurasia is represented by a single clade, but the population in Gwaii Hanaas and nearby Prince of Wales Island, Alaska is unique enough to be its own clade. The Haida Ermine (along with *M. e. celenda* and *M. e. seclusa),* are considered the best mammalian evidence for the existence of the North Pacific glacial refugium (Fleming and Cook 2002). The population on Haida Gwaii may take on more significance because islands close to Prince of Wales Island recently have been colonized by the Continental and Holarctic clades, raising concerns about the maintenance of genetic diversity, hybridization, and parasite exchange of the island clade, and potentially making Haida Ermine the only representative of this unique genetic diversity (Dawson *et al.* 2014).

## DISTRIBUTION

### Global Range

Based on existing taxonomy, the Haida Ermine is endemic to the Haida Gwaii Archipelago (Queen Charlotte Islands) located about 80 km off the north central coast of British Columbia (Hall 1951; Foster 1965; Cowan 1989; Reid *et al.* 2000). Two closely related subspecies occur on Prince of Wales Island and adjacent Suemez and Heceta Islands of the Alexander Archipelago, Alaska, approximately 80 km distant (Fleming and Cook 2002; Figure 2). It is possible that the Ermine on and near Prince of Wales Island are also Haida Ermine (Cook *et al.* 2006) but, presently, those Ermine are considered a different subspecies (see **Morphological Description**).

### Canadian Range

There are over 200 islands in the 300-km long Haida Gwaii Archipelago (Banner *et al.* 2014). The two largest islands, Graham (6389 $km^2$) in the north and Moresby (2549 $km^2$) in the south, are interspersed with many smaller islands. Haida Ermine have been verified (*i.e.*, specimen or photograph) at multiple locations on the two large islands (Figure 3). Non-verified records (*i.e.*, observation, trapped but carcass not submitted) from local trappers, hunters, and residents are from the same known range, and from Louise (272 $km^2$) and Burnaby (66 $km^2$) islands (Reid *et al.* 2000). There is a potential, historical record of Haida Ermine on SGaang Island at the southern end of Haida Gwaii; the name of a longhouse refers either to an incident when a Haida Ermine appeared during construction, or to the name of the hole that Ermines use (Burles *et al.* 2004; Ermine, *haidarum* subspecies Recovery Team (2009; hereafter 'Recovery 2009'). This record is not used in this report because it is of unknown age but likely too old to be relevant to today's status.

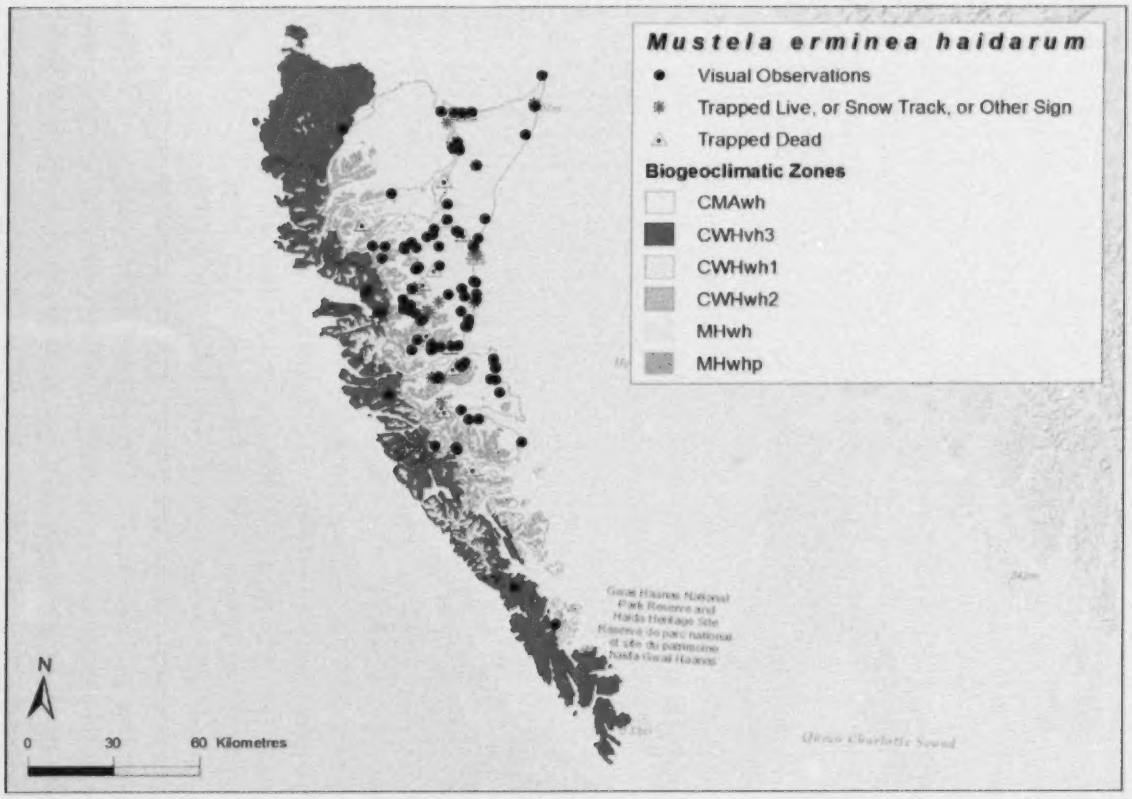


Figure 3. Locations of verified and unverified Haida Ermine records on Haida Gwaii, British Columbia, since 1898. The Archipelago is dominated by Graham Island in the north, and Moresby Island in the south. The biogeoclimatic zones are described in Banner *et al.* (2014); most of the Archipelago is Coastal Western Hemlock Wet Hypermaritime - submontane variant (CMAwh) and Coastal Western Hemlock Very Wet Hypermaritime Zone - Haida Gwaii variant (CWHvh3). Map produced by Jenny Wu, COSEWIC Secretariat.

The number of subpopulations is unknown but it appears most Haida Ermine reside on the two main islands (Graham, Moresby); there are no records of Haida Ermine on islands separated by more than 250 m from an island known to contain Haida Ermine. The other islands with records (Louise, Burnaby islands) are connected at extreme low tide to the larger islands containing Haida Ermine by distances of < 100 m (Louise to Moresby, Burnaby to Moresby) and 250 m (Graham and Burnaby islands). Moresby and Graham Islands are only 250 m apart and nearly connected at low tide (Burles *et al.* 2004). Although Ermine are capable of swimming long distances (see Dispersal and Migration), it appears that movement between more distant islands is limited. Given the similarity in habitat across much of the Haida Gwaii, it is possible that Haida Ermine occur on other nearshore islands, but none have been recorded, despite multiple surveys (see **Search Effort**).

Most non-verified observations recorded in Reid *et al.* (2001) were around settlements that had the highest human populations (near Masset, Port Clements, Tlell, Skidegate, Queen Charlotte City, Alliford Bay, and Moresby Camp). On Graham Island, Reid *et al.* (2001) found that observations were clumped on Delkatla and Canadian Forces Base Masset; middle Masset Sound near mouth of Watun River; Kumdis Creek; tributaries to southern Mayer Lake; Mayer River; lower Yakoun River; confluence of Gold Creek and Yakoun River; lower Phantom Creek and Yakoun River; Lawn Creek and Lawnhill coast; Tarundl Creek and lower Honna River. On Moresby Island observations were from: lower Sachs Creek and Alliford Bay; the stream draining into Skidegate Inlet along the South Main road; Mosquito Lake and Creek; Copper Creek and Copper Bay.

**Extent of Occurrence and Area of Occupancy**

The extent of occurrence (EOO) was calculated at 10,816 $km^2$, based on a minimum convex polygon around all verified and non-verified observations (excluding SGaang Island) (see **Canadian Range**). Excluding historical museum records (ranging from 1900 to 1991) from this calculation did not change the extent of occurrence because all museum records were within the current extent of occurrence. The index of the area of occupancy (IAO, based on a 2 km x 2 km grid) was 1,052 $km^2$ (263 grids), using British Columbia Conservation Data Centre data, as well as Haida Ermine sightings and museum records. The IAO was 1,032 $km^2$ when museum records were excluded.

**Search Effort**

The Search Effort and Sampling Effort and Methods sections of this report are combined because the methods used to determine the distribution, habitat use, and population trend of Haida Ermine are the same.

Haida Gwaii is composed of numerous islands, so access to many of the islands is difficult and parts of the larger islands (*i.e.*, Graham and Moresby) are inaccessible during winter. Most of the search effort has been applied to the eastern, lower elevation areas of Graham and Moresby islands, but sections of the larger islands, and many of the smaller islands, have also been surveyed; approximately 20% of the area has been surveyed (Figure 4). The western sides of the islands generally have fewer roads, are steep, and are largely inaccessible, especially during winter when many roads are closed (Wijdeven pers. comm. 2014). Surveys have been conducted on numerous other islands and in western areas, and each survey had a similar result with very few Haida Ermine recorded. As a habitat generalist (see **Habitat Requirements**), and with most threats likely existing at similar levels across much of the range (see **Threats and Limiting Factors**), it is unlikely that areas under-surveyed have greater abundance of Haida Ermine than areas well-surveyed, and they may even have fewer animals (see **Habitat Requirements**). Typically, unless densities are very low, the presence of Ermine in an area is readily established; they are easily trapped in live or lethal traps, are not a secretive species, and are easily identified by the public (King and Powell 2007).

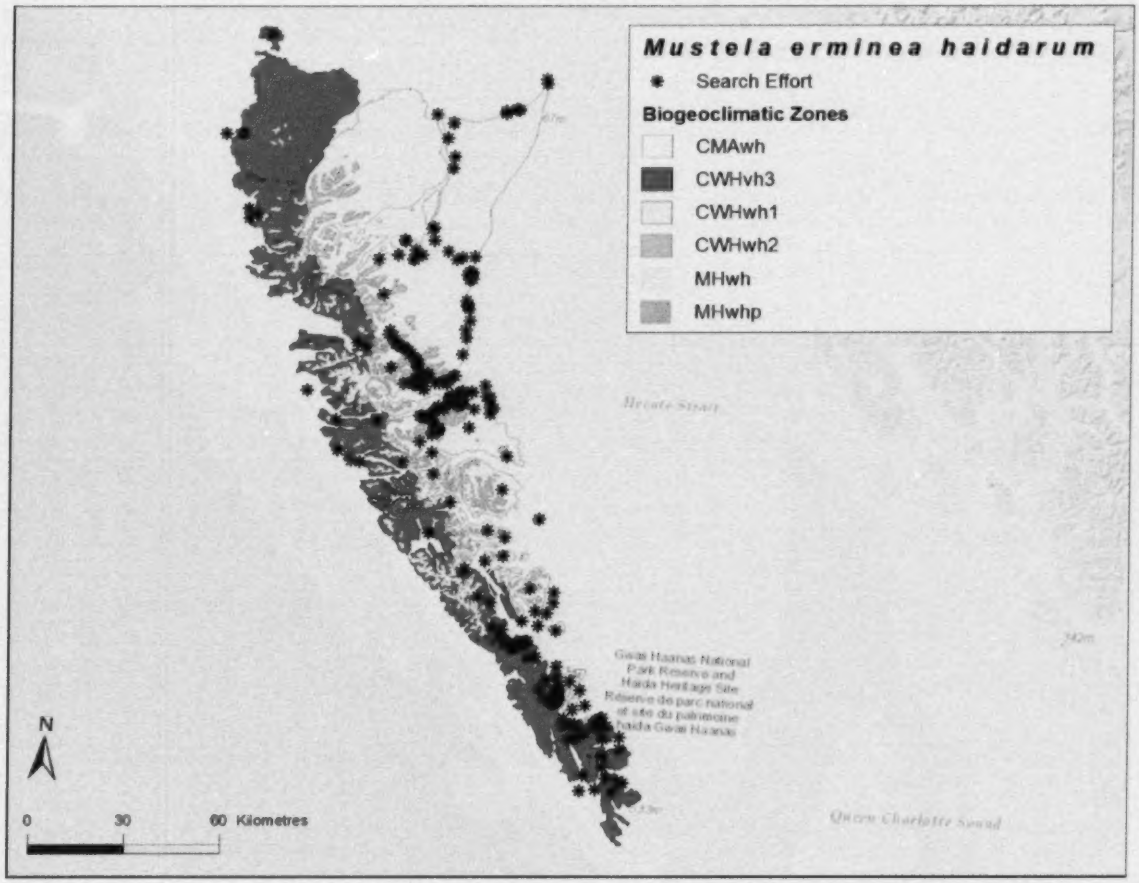


Figure 4. Approximate location of surveys for Haida Ermine on Haida Gwaii, British Columbia, since 1960. Search effort involved traps, camera traps, sniffer dog, track plates, hair snares in forest, and track surveys along roads (see Search Effort). See Figure 3 for description of biogeoclimatic zones. Map produced by Jenny Wu, COSEWIC Secretariat.

The search effort is as follows:

Four collecting expeditions were made between 1900 - 1920 for museum specimens (see **Fluctuations and Trends**). Foster (1965) surveyed mammals on 45 islands from 1960 - 1961. The focus of the Foster survey was to document endemic mammals, including Haida Ermine.

Surveys undertaken from 1992 - 2014 are summarized in Tables 1 and 2. During the 1990s, intensive sampling for Haida Ermine was conducted by Reid *et al.* (2000). They used a variety of inventory techniques in a range of habitat types, including: Sherman live-traps (50 trap nights in summer 1992, 2,301 trap nights in fall 1993, 3,000 trap nights in spring 1995 and 1,414 trap nights in spring 1997), snow-tracking (22 km on foot and 900 km by road), and track stations (2,692 nights in 1997 and 1998).

During 2004 - 2005, Burles *et al.* (2008) conducted sampling for Haida Ermine in areas where sightings had occurred previously (e.g., eastern Graham Island, Burnaby Island, Ikeda Cove). They used hair snares (32 locations, 871 nights), den boxes (which proved to work well on Ermine in New Zealand) (22 locations, 3,460 nights), remote cameras (31 locations, 481 nights), and snow tracking (70 km, 4 nights off-road).

The stomachs of 152 Pacific Marten (*Martes caurina;* Carr and Hicks 1997) trapped on Haida Gwaii in the 1990s were examined for the presence of Haida Ermine hair or bones (Nagorsen 2006).

Most of the search effort has been based on fieldwork but local knowledge was also obtained from residents of Haida Gwaii. Reid *et al.* (2000) conducted 325 interviews with the public, including trappers, between 1997 - 1998. An observation was considered a record by the authors if it had at least one of the following characteristics: elongate body with long tail and short legs that was either rusty brown or white, a black tip on the tail, and a bounding gait. Of the 162 records, 75% (121) were visual observations and 57% of those were of the diagnostic white pelage. Trapped animals accounted for 15% of the 162 records. The remaining records were from tracks in snow (4%; most made by experienced trappers), and various sources (*i.e.*, 6% were kept as pets, killed by cats, or identified based on puncture wounds left on dead chickens) (Reid *et al.* 2000). Although these records are considered non-verified because of the lack of photo or specimen, the criteria for acceptance by Reid *et al.* (2000) and the ease of identifying weasels suggests that the records are valid.

A total of 21 islands from the north to south end of Haida Gwaii were monitored with camera traps (1643 trap nights) from 2010 - 2011 as part of monitoring for predation effects of invasive species on nesting seabirds (Bergman 2012). An additional 47 islands have since been monitored with similar intensity. The 68 islands range in size from 0.01 to 20 $km^2$ (Bergman pers. comm. 2014).

The Haida Ermine Recovery Strategy (Recovery 2009) recommended field testing of existing and new detection methodologies as a priority activity towards determining population size, density, and distribution. Renewed efforts included the deployment of additional digital cameras, both systematically and opportunistically (following up on reported sightings) over a number of years. In 2013 and 2014, 339 km of ground was surveyed on Graham Island by a dog trained to locate Ermine scat (Wijdeven pers. comm. 2014; Table 2). Researchers were confident that Ermine scat would be found if it was present because the dog was able to identify sample Ermine scats during the survey (Wijdeven pers. comm. 2014).

## HABITAT

### Habitat Requirements

The vegetative habitat associations, and the importance of critical natural features for the Haida Ermine, are largely unknown (Parks Canada Agency 2011). Some inferences are possible from studies of habitat associations of other Ermine subspecies. Ermine are considered to be habitat generalists, occurring in a wide range of vegetation types, such as open tundra, and mature, closed forest (King 1983; Fagerstone 1987; King and Powell 2007). They persist year round in high alpine regions (*i.e.*, Fitzgerald 1977), as well as along coastlines.

Some information is available from observational data on Haida Ermine from public interviews conducted by Reid *et al.* (2000). Most of the 130 observations (94%) were from the Submontane Wet Hypermaritime biogeoclimatic zone (Banner *et al.* 2014), and all but one of these were made below 350 m altitude along most of the eastern flank of the Haida Gwaii archipelago. Only six records were from the CWHvh2 zone variant, which occurs in very wet low elevation areas on the west side of the Windward Mountains, two were from the CWHwh2 (above 350 m elevation on the east side of the Windward Islands). No records were from the Alpine Tundra zone (Reid *et al.* 2000).

Most (87%) of the 130 sightings were in forested landscapes; of these, 69% were in coniferous forest. Haida Ermine were observed in closed old-growth forest but also frequently (57% of sightings) in second-growth, or non-forest areas, suggesting Haida Ermine do not require old-growth forest environments (Reid *et al.* 2000). In forests similar to Haida Gwaii on Olympic Peninsula, Washington, Ermine were most abundant in thinned second-growth Douglas Fir (*Pseudotsuga menziesii*) forest with dense understory vegetation (Wilson and Carey 1996). The same pattern exists in different forest types, such as the boreal forest of Ontario where Ermine did not appear to select particular age classes and were common in both logged, and unlogged, areas (Thompson *et al.* 1989).

There is a suggestion that Haida Ermine select riparian zones by Haida Ermine (Reid *et al.* 2000). Most sightings were at low elevation (<50 m) and within 100 m of water bodies (ocean, river or creek; Reid *et al.* (2000), although there is uncertainty regarding the precision of these sightings (Parks Canada Agency 2011). At elevations similar to Haida Gwaii, Ermine in Oregon were more abundant in riparian, versus upland, sites, likely because of denser understory in riparian zones (Doyle 1990). Ermine also were more abundant in riparian sites than upland sites in northern Vancouver Island (Mowat *et al.* 2000) and the Okanagan valley (Gyug 1994).

Most records of Haida Ermine have been in eastern areas of the island where people live but this result may not be overtly biased. On Haida Gwaii, numerous logging roads extend to higher elevations and have been surveyed, but few (12%) of the sightings in Reid *et al.* (2000) were made in areas above 50 m asl. As well, there is evidence that lower elevation forest on the islands' east side actually represents quality habitat; sightings of a similarly small Ermine subspecies on northwestern Vancouver Island (*M. e. anguinae*), in a range with very similar habitat to Haida Gwaii, were also mainly made in the drier, open shrubby vegetation in the eastern part of the island, and not in the wetter, higher elevation western slope areas (Mowat *et al.* 2000).

The wide range of ecosystems used by Ermine suggests that habitat selection is related more to location of prey, and the conditions that produce abundant prey, such as more productive sites (Mowat and Poole 2005). Vole species are an important food item to Ermine (see Diet), but voles are not present on Haida Gwaii and it is assumed that other small mammal species and birds are influencing Haida Ermine habitat use. Although Ermine will climb trees to access nests, most predation by Ermine occurs at ground level (King and Powell 2007), and structures that influence prey items at ground level likely affect where Haida Ermine forage. Dense vegetative cover at the ground and understorey level (*i.e.*, < 2 m) often is associated with abundant small mammal prey species (Miller and Getz 1977; Carey and Harrington 2001). Doyle (1990) recorded that prey and Ermine were most abundant in dense understorey areas in Oregon. Separating the function of food from security is difficult, but dense cover may also be important as protection for Ermine from predators. Coarse woody debris is correlated with protection of Ermine from predators (Samson and Raymond 1998), as well as increasing abundance of small mammals (Carey and Harrington 2001; Fauteux *et al.* 2012).

In summary, Haida Ermine have been recorded in a variety of open and closed canopy environments, but in forest, where most records were obtained, it appears that food and protection associated with understorey vegetation is most important. Based on habitat in areas where Haida Ermine have been recorded, the important structures of Haida Ermine habitat are well-structured understorey, extensive ground cover, large coarse woody debris, and low elevation, riparian forests (Burles *et al.* 2004; Recovery 2009).

**Habitat Trends**

Dramatic change in forest habitats have occurred on Haida Gwaii but the direct impact on Haida Ermine is unquantified. Forest clearcut activity was once extensive on lowland parts of Haida Gwaii (Golumbia 2000; Martin and Baltzinger 2002). Forestry is ongoing in approximately 25% of CWHwh1, the biogeoclimatic zone variant that contains most records of Haida Ermine (Parks Canada Agency 2011). Because Ermine use a wide range of environments, the conversion of old-growth forest to early successional stages likely does not directly affect habitat use by Haida Ermine (see **Habitat Requirements**). However, if populations of Deer increase because of early successional forest, there could be increased loss of ground cover in non-harvested forest, and increased risk to Haida Ermine.

The most significant habitat trends are changes to vegetation structure caused by Sitka Black-tailed Deer (*Odocoileus hemionus sitkensis*; hereafter, 'Deer'). Introduced in 1878, Deer have colonized the entire known range of Haida Ermine, and all but 11 small islands in the Archipelago (Daufresne and Martin 1997; Parks Canada Agency 2012). Deer have heavily impacted the understorey vegetation of forests since at least the 1980s (Pojar *et al.* 1980; Golumbia 2000) (Figure 5). In a comparison of 40-$m^2$ vegetation survey plots on islands with Deer (33 deer/$km^2$; n = 150 plots) to islands without Deer (n = 16 plots), Daufresne and Martin (1997) documented the complete absence of Salmonberry (*Rubus spectabilis*), Salal (*Gaultheria shallon*), Bracken (*Pteridium aquilinum*), and False Lily-of-the-Valley (*Maianthemum dilatatum*), and much reduced foliage of Red Huckleberry (*Vaccinium parvifolium*), and Western Redcedar (*Thuja plicata*). The first four species were the most abundant understorey species in areas where Deer were absent, indicating Deer browsing dramatically reduced the most common plant species. In an enclosure study (Bennett 1996 *in* Baltzinger and Martin 1998) a 6250-$m^2$ exclosure had 750 Western Redcedar saplings/ha (>1.5 m high) compared to zero in areas where Deer were able to browse. Small saplings < 0.5 m were abundant. Similarly, Stockton *et al.* (2005) found islands that had Deer for > 50 years had < 10% vegetation cover, as compared to > 80% cover on islands without Deer. The loss of common species resulted in a much different forest, with the dense shrub layer being replaced by open ground cover and mosses (Pojar *et al.* 1980; Stockton 2003).

Figure 5. Photographs illustrating the difference in understorey vegetation in areas without introduced Black-tailed Sitka Deer (Low Island), and on the right, areas with Deer browsing (East Limestone Island). Source: Martin (2001).

The potential effects of Deer browsing on Haida Ermine are believed to be twofold; first, a reduction in understorey vegetation has diminished cover for Haida Ermine and probably rendered them more susceptible to aerial and ground predators, and second, decreased understorey cover has altered prey populations used by Haida Ermine. For example reduced berry-producing plants (*i.e.*, Salal, Huckleberry) would affect prey populations, while loss of False Lily-of-the-Valley and Bracken represents a loss of cover. Allombert *et al.* (2005a) found that Haida Gwaii islands containing Deer experienced a 55 - 70% reduction in songbird density, compared to islands without Deer. The greatest decline (93%) was in abundance of bird species with the highest dependence on understorey habitat. For example, Fox Sparrow (*Passerella iliaca*), Song Sparrow (*Melospiza melodia*), Orange-crowned Warbler (*Vermivora celata*), and Pacific Wren (*Troglodytes pacificus*) are common ground / shrub layer nesters and probable food items for Haida Ermine, but were absent, or significantly reduced where Deer have been browsing for > 50 years. The bird community switched from an understorey-dominated community to one where most species were in the forest canopy (Allombert *et al.* 2005a). As well, vegetation below the browse line (e.g., < 150 cm) on islands with > 50 years of Deer feeding had 8 times less insect abundance, and 6 times lower density, than islands lacking Deer (Allombert *et al.* 2005b).

Overall, Deer browsing has decreased the habitat quality of forests in much of the known range of Haida Ermine, and likely has significantly impacted populations of Haida Ermine because of increased risk of predation, and reduction in available prey. Seeds, fruit, and insects associated with the forest vegetation are consumed by small mammals and birds, which in turn are the main food items for Haida Ermine (see Diet); although not studied, it is likely that small mammal populations have been affected by Deer browsing.

## BIOLOGY

Although limited research has taken place on the biology of the Haida Ermine, it is likely that breeding and feeding behaviour is similar between subspecies and it seems reasonable to extrapolate from other similar Ermine subspecies.

### Life Cycle and Reproduction

All Ermine subspecies have a polygamous mating system, with several exclusive female home ranges occurring within the male's home range (Erlinge 1977); thus, it is very likely that the Haida Ermine possess the same mating system. Ermine mate in the summer/autumn, implant the zygote the following spring (Fagerstone 1987) and give birth 4 weeks later (King 1983). Litter size range is 4 – 13 kits and is strongly dependent on prey abundance. At very low prey densities, no young are produced (Erlinge 1983; King 1983; Jedrzejewski *et. al.* 1998; Korpimaki *et al.* 1991). Sex ratio at birth is 1:1 (King and Powell 2007). Adult size is reached at 4 - 6 months and 10 months for females and males, respectively. Females can become impregnated by 3 months of age, but due to delayed implantation, the age of first reproduction is one year (Fagerstone 1987).

Ermine breed early, have short lifespans, and their populations change dramatically on an annual basis because of fluctuating food supply (Raymond and Bergeron 1982; King and Powell 2007). In Sweden, Erlinge (1983) recorded a 40% mortality rate for males in year 1 and 68% in year 2, and 54% in year 1 and 73% in year 2 for females. Survival of 1-year-old Ermine is highly dependent on food supply; mortality rates of 1-year-old Ermine were >90% when prey populations began to decline, compared to 73% when more food was available (King and Powell 2007). Maximum longevity is estimated as 7 years (Fagerstone 1987) but a four-year old Ermine is very rare (*i.e.*, 1 of 47 Ermine (2%) and average longevity (after independence from parent at 3 - 4 months) is 1.4 for males and 1.1 years for females (Erlinge 1983). The most significant variable affecting survival was competition for food by other predator species (Erlinge 1983). The rapid change from positive to negative growth rates over 1 - 2 year periods means that local Ermine populations are considered unstable (King and Powell 2007). The impact of such oscillation on low density Haida Ermine is unknown but raises concern that occasional stochastic mortality events may be significant to subpopulations.

**Generation Time**

Demographic data on Ermine from elsewhere are used because the generation time for Haida Ermine is unknown. The calculation is based on [1/estimated annual adult mortality rate] + estimated age of first reproduction. Two estimates are made because the Ermine mortality rates are highly variable. At a 47% mortality rate (average of 40% male and 54% female in first year; Erlinge 1983), and age of first reproduction set at 1 year (see Life Cycle and Reproduction), generation time is calculated as 3.1 years. At a 90% mortality rate (King and Powell 2007), generation time is calculated as 2.1 years. The generation time is between 2 – 3 years.

**Diet**

Little is known about Haida Ermine food habits. The only quantified diet analysis (n = 9) during examination of stomach, intestine, and scats found remains of Keen's Mouse (*Peromyscus keeni*) (formerly Northwestern Deer Mouse, *Peromyscus maniculatus keenii* and *P. m. sitkensis*; Allard and Greenbaum 1988), Dusky Shrew (*Sorex monitcolus elassodon*), a large unidentified bird (probably gull *Larus* spp.), Pacific Wren, and a small fish (species unknown) (D. Nagorsen unpubl. data *in* Recovery 2009). Haida Ermine also are believed to feed on marine invertebrates in the intertidal zone. Haida Ermine likely scavenge on fish (e.g., post-spawning salmon (*Oncorhynchus* spp.) that have been discarded by Black Bear (*Ursus americana*)) (Reid *et al.* 2000) and on Deer. There are six records (to 1997) of Haida Ermine chasing or killing chickens, and single observations of a Haida Ermine chasing a Black Rat (*Rattus rattus*) and killing swallows (*Hirundo* sp.) (Reid *et al.* 2000). Scavenging on Muskrat (*Ondatra zibethicus*), trap baits, and food from a cookhouse, has been recorded (Reid *et al.* 2000).

In North America, Ermine consume a wide range of species (birds, eggs, domestic poultry, mammals, including scavenging on many items) but much of their diet, population dynamics, and morphology is related to small mammals such as shrews, mice, and voles (King and Powell 2007). The most important group seems to be voles, likely due to the vole's body size and abundance. Ermine consumption and habitat use is most associated with the abundance of whichever vole species is present, such as *Microtus oeconomus* on Kodiak Island, Alaska (Clark 1958), *M. montanus* in Nevada (Fitzgerald 1977), *Clethrionomys rutilus* in southwest Yukon (O'Donoghue *et al.* 2001) and *M. pennsylvanicus* in Ontario farmland (Simms 1979). Voles are absent from Haida Gwaii (Burles *et al.* 2004), which has raised questions about what food item is critical to Haida Ermine, as well as conjecture that Haida Ermine populations must have always been at low density if such an important food item is missing (Reid *et al.* 2000, Edie 2001).

The only small native mammal prey on Haida Gwaii are Keen's Mouse and Dusky Shrew (Reid *et al.* 1999, 2000; Burles *et al.* 2004). Keen's Mouse eat fruit and seed and are found in a wide range of environments, from seashore to alpine areas across Haida Gwaii (Cowan and Guiguet 1965; Foster 1965). Studies from similar coastal Alaskan sites suggests that the relative abundance of Keen's Mouse is related to an annual fluctuation in food supply (Hanley and Barnard 1999a) that causes dramatic annual fluctuations in population density (Hanley and Barnard 1999b). The Dusky Shrew on Haida Gwaii is likely widely dispersed (Foster 1965). They have been captured in herbaceous cover above treeline and along rocky coastline (Burles *et al.* 2004) but are considered less common than Keen's Mouse (Burles *et al.* 2004). For example, camera trap results from 21 islands documented 37 Mice versus 18 Shrews (Bergman 2012). Populations and trends of small mammals on Haida Gwaii are unknown.

Haida Ermine may also prey on introduced Black and Norway Rat (*Rattus norvegicus*) and Red Squirrel. However, the small size of the Haida Ermine likely limits its effectiveness as a predator of Red Squirrels or rats. In Alberta, Red Squirrel comprised a large portion of Ermine diet, but the male Ermine in the area weighed 150 g (n = 10), while male Haida Ermine only weigh 110 g (n = 4) (Lisgo 1999) and likely are ineffective predators on Red Squirrels. Female Ermine in Alberta weighed 52 g and rarely preyed on Red Squirrels. Female Haida Ermine weigh 69 g (n = 2), suggesting that they also do not feed on Red Squirrels (Burles *et al.* 2004). Rat and Muskrat are heavier than Red Squirrel and it seems likely that the only non-carrion sources of mammalian prey of Haida Ermine are the Deer Mouse and Dusky Shrew.

Ermine feed on birds and eggs of species that nest on the ground or in understory vegetation, as well as a wide variety of invertebrates and fruit (King and Powell 2007).

**Predation**

The only confirmed predation of Haida Ermine is a record of three kills by domestic cats (*Felis catus*; 2% of all known sources of mortality - Reid *et al.* 2000). Predation by Raccoons (*Procyon lotor*) has been suggested as a factor in declines; based on anecdotal observations, fewer sightings of Haida Ermine were made on Graham Island (Masset Inlet) after Raccoons were introduced to the Haida Gwaii Archipelago (Parks Canada Agency 2011). Several birds of prey occur on Haida Gwaii, including the Queen Charlotte Island Goshawk (*Accipiter gentilis laingi*), Sharp-shinned Hawk (*A. striatus*), Red-tailed Hawk (*Buteo jamaicensis*), Peale's Peregrine Falcon (*Falco peregrinus pealei*), Bald Eagle (*Haliaeetus leucocephalus*), and Queen Charlotte Saw-whet Owl (*Aegolius acadicus brooksi*). The Queen Charlotte Island Goshawk is relatively rare and so the most likely predator of Haida Ermine is the Red-tailed Hawk. Food habits for these species on Haida Gwaii are not known, but modelling on raptors and Ermine elsewhere suggests raptors can limit Ermine populations, even if Ermine represented only 1% of their diet (Powell 1973).

American Marten (*Martes americana*) have been recorded killing Ermine elsewhere (Weckwerth and Hawley 1962; Thompson and Colgan 1990; Jędrzejewski *et al.* 1995) and thus the very similar Pacific Marten is a potential predator of Haida Ermine. Analysis of 152 Pacific Marten stomachs from Haida Gwaii revealed no Haida Ermine remains (Nagorsen *et al.* 1991; Nagorsen 2006) but trappers have noted Pacific Marten eating trapped Haida Ermine (Burles *et al.* 2004) and Edie (2001) argued that a much larger sample of Pacific Marten stomachs than presently used would be need to be examined to reveal the presence of Ermine, and that even predation on a small number of Ermine would be significant to the population.

**Physiology and Adaptability**

Ermine have a high metabolic rate and acquisition of food is vital to maintaining body temperature. Ermine eat 5 to 10 times per/day and will die without frequent intake. Ermine consume approximately 19 to 32% of their body weight daily (King and Powell 2007) and the smaller Haida Ermine likely is under greater pressure to acquire food. Staying warm is achieved by using insulated sites (e.g. nests in burrows, foraging under snow), rather than fat deposition (King and Powell 2007).

**Space Use**

Individual Haida Ermine have not been tracked and there is no information on daily movements or home range. In Ermine, both male and female Ermine are territorial, with male home ranges being larger. In a farmland and woodlot environment of southern Quebec, male home ranges averaged 0.2 $km^2$ (n = 11), four times larger than average female home range size (0.05 $km^2$; n = 12) (Robitaille and Raymond 1995). Home ranges as large as 0.25 $km^2$ (males) and 0.15 $km^2$ (females) were recorded in similar environment in southern Ontario (Simms 1979). In mixed boreal forest of eastern Alberta, Lisgo (1999) recorded male average home ranges of 1.5 $km^2$ (n = 4), and 0.8 $km^2$ (n = 4) for females. Decreased food availability results in larger home ranges as Ermine must forage further to acquire food (King and Powell 2007).

Ermine density is positively associated with food supply (King and Powell 2007). In North America, Ermine densities range from 4 to 11 Ermine/$km^2$ (Fagerstone 1987). Daily movement distances over 24-hour periods of 500 m (Robitaille and Raymond 1995) and 600 m (Simms 1979), and distances of 6 km for multi-day hunting periods (Simms 1979), have been recorded.

**Dispersal and Migration**

Ermine offspring leave parental care after about 3 to 4 months and typically disperse from natal range in the autumn (Fagerstone 1997; King and Powell 2007). Distances can be lengthy and one Ermine in Alaska moved 35 km between August and March (Burns 1964). The density of territorial adult males likely influences how far a juvenile travels to find an available territory (King and Powell 2007).

It has been suggested that Haida Ermine may not be able to swim greater than 100 m because Haida Ermine have not been recorded on islands separated from colonized islands by more than 100 m of permanent water (Recovery 2009). However, Ermine have been recorded swimming distances of 1.6 km (and perhaps 2.2 km) to reach Arctic islands with breeding seabirds (Cairns 1985). Also, a Haida Ermine was observed in 1980 on a logging boom in Skaat Harbour, Moresby Island (Reid *et al.* 2000), suggesting wider movement on floating debris is possible.

**Interspecific Interactions**

There may be a negative relationship between Pacific Marten and Haida Ermine. Although both species have been together for thousands of years (Burles *et al.* 2004), the increase in the Pacific Marten population coincided with a decrease in Haida Ermine. Based on the experience of registered trappers and anecdotal observations, Pacific Marten populations are believed to have increased by five to tenfold on Haida Gwaii since the 1940s (Edie 2001; Reid *et al.* 2000). Declines in trapped Haida Ermine were noted after the 1950s (Reid *et al.* 2000). Local trappers noted Haida Ermine became temporarily abundant in the late 1960s after Pacific Marten populations were reduced during a severe tick (species unknown) infestation (Edie 2001).

The main reason for increased Pacific Marten numbers is believed to be elevated populations of introduced mammal species, such as Red Squirrel, but in particular the availability of Deer, which were introduced in the late 1800s (Golumbia 2000). Before the introduction of Deer, no other ungulate source of carrion was available, other than the now extinct native Dawson's Caribou (*Rangifer tarandus dawsoni*). Other introduced mammals include Black Rat, American Beaver (*Castor canadensis*), Muskrat, Raccoon, and Red Squirrel, which were brought to the islands in the 1940s - 1950s (Golumbia 2000).

The frequency of introduced mammals in the stomachs of Pacific Marten was 50%, whereas native mammals (Keen's Mouse and Dusky Shrew) contributed 7% (Nagorsen 2006). Deer hair was most evident (at 35% frequency) in Pacific Marten stomachs (Nagorsen *et al.* 1991). Introduced Red Squirrel comprised a small percentage of the diet (5% frequency; Nagorsen *et al.* 1991).

Increasing numbers of Pacific Marten may elevate inter-specific competition between Pacific Marten and Haida Ermine for a limited food supply. For example, 10 of 20 grouse nests with monitoring cameras in 2013 were depredated by Pacific Marten (Wijdeven pers. comm. 2014). Pacific Marten appear to be doing well on Haida Gwaii. According to trappers, populations are increasing, and the fat content on 85 Pacific Marten carcasses supplied by trappers was high, even though they were trapped during December and January when furbearers typically are less healthy (Wijdeven pers. comm. 2014). Direct predation by Pacific Marten on Haida Ermine also is a possible mechanism (see Predation).

Haida Ermine do not seem to have benefited from new food items as well as Pacific Marten have. Haida Ermine could scavenge on Deer but generally are not significant predators of rats or Red Squirrel (see Diet). Introduced species may also be consuming small prey needed by Haida Ermine; populations of Keen's Mouse and Dusky Shrew declined on Haida Gwaii islands that contained non-native rats (Foster 1965; Burles *et al.* 2004), and Red Squirrels are known predators of nesting small mammals and birds (Steele 1998).

Parasites and diseases have not been assessed in Haida Ermine, other than in a single specimen that contained numerous lungworm parasites (likely a species of *Aleurostrongylus*) (Coates 2004). Ermine in general are not considered susceptible to epizootic events that lead to significant mortality, but they are susceptible to tularemia, canine distemper, Aleutian disease of Mink (*Neovison vison*), and bacterial infections such as *Borrelia burgdorferi* (King and Powell 2007). Numerous helminth parasites have been recorded in Ermine, as well as a species of louse (*Trichodectes ermineae*) and tick (*Ixodes gregsoni*) only found on Ermine (Jennings *et al.* 1982; Lindquist *et al.* 1999).

## POPULATION SIZES AND TRENDS

### Sampling Effort and Methods

Refer to the **Search Effort** for sampling and methods.

### Abundance

There are an estimated 263 records of Haida Ermine, since 1898. As of 1999, 32 verified records existed in museum collections and the BC Conservation Data Centre (Reid *et al.* 2000). Interviews with the public resulted in 162 additional records made between 1920 and 1997 (75% were visual sightings), including records for Louise (in 1983, 1986, 1993) and Burnaby (1985) Islands. Since 2001, an additional 23 Haida Ermine were verified based on trapped animals, animals caught on camera, or caught by trappers. The approximately 1622 camera nights produced photographic evidence of Haida Ermine at three sites (two photos and one video). In addition to confirmed records, surveys conducted by sniffer dog located 12 suspected Ermine scats on Graham Island in 2013, and 4 - 6 in 2014 (Wijdeven pers. comm. 2014), representing an unknown number of individuals. Camera surveys conducted by Parks Canada staff on 68 islands did not record Haida Ermine (Bergman 2012, pers. comm. 2014).

In the last 20 years, the most verified Haida Ermine individuals located in one year is five (Reid *et al.* 2000; Wijdeven and Cober unpubl.), and the highest number reported by the public in one year has been eight, in 2007 (Parks Canada Agency 2011).

In summary, the abundance of Haida Ermine is unknown but it is likely that very few exist, likely fewer than 1000 mature individuals. The population size on each of the two main islands is unknown but may exceed the threshold of 250 mature individuals used in COSEWIC status criteria. Extensive surveys have been conducted by numerous methods and very few observations have ever been made. There is less survey effort in higher elevations and western parts of the islands, but if present, it is unlikely that Haida Ermine exist at higher densities than densities found in areas where most of the surveys have occurred, and likely are at even lower densities (see **Habitat Requirements**).

## Fluctuations and Trends

A historical decline of Haida Ermine is inferred because the species was readily captured in the past. The first recorded specimen was from 1898 (Preble 1898) and collections for museum specimens were made over four expeditions (Hall 1951). According to Burles *et al.* (2008) these early collectors had low search effort but had high trapping success, suggesting that Haida Ermine were probably more common in the early 1900s than at present. In 1900, Osgood (1901) trapped four Haida Ermine in a 1-month period, W. Brown caught three in 2 weeks in 1914, J. Munro caught four in 1918, and A. Brooks caught five in 1920 (Nagorsen, unpublished data *in* Edie 2001). By contrast, trapping efforts using similar methods in the same region as earlier surveys and over a 5-year period (1992 - 1997), and conducted more intensely (*i.e.*, > 6,600 trap nights), yielded only two animals (see **Search Effort**; Table 1). More extensive and varied methods (*i.e.*, road surveys, camera traps, sniffer dogs, etc.) have been used in the last 10 years, and would have documented Haida Ermine if they were common. Instead, only three verified or probable records (plus 16 probable scats of unknown number of individuals) were made from 2319 camera nights, 7023 nights of track plates, den boxes and hair snares, and 339 km of sniffer dog tracking, mostly in areas where Haida Ermine traditionally were located (Table 1). In the last 10 years another 12 animals were recorded from incidental trapping by trappers, but trap effort is unknown (Cober unpubl. data).

**Table 1. Methods used and efforts expended to detect Haida Ermine presence, 1992-2013.**

| Activity | Year(s) | Trap Nights | Results | Source |
|---|---|---|---|---|
| Live traps | 1992-97 | >6700 | 2 Ermine | Reid *et al.* (2000) |
| Track plates | 1997-98 | 2692 | 0 Ermine tracks | Reid *et al.* (2000) |
| Snow tracking (forest) | 1997-98 | | 0 Ermine tracks over 23 km | Reid *et al.* (2000) |
| Snow tracking (road) | 1997-98 | | 0 Ermine tracks over 900 km | Reid *et al.* (2000) |
| Pacific Marten carcasses | 1983-86; 2003 | | 0 Ermine in 152 Pacific Marten stomachs | Nagorsen *et al.* (1991); Nagorsen (2006). |
| Trap type test | May 2004 | | 0 Ermine | Burles *et al.* (2008) |
| Hair snares | May 2004 | 871 | 0 Ermine | Burles *et al.* (2008) |
| Den boxes | June 2004 | 3460 | 2 Ermine (probable) | Burles *et al.* (2008) |
| Snow tracking | 2004 | | 0 Ermine over 70 km | Burles *et al.* (2008) |
| Cameras (film) | July 2004 | 99 | 0 Ermine | Burles *et al.* (2008) |
| Cameras (digital) | July 2005 | 598 | 0 Ermine | Burles *et al.* (2008) |
| Cameras | 2007-13 | 1622 | 3 Ermine | B. Wijdeven unpubl. data 2014 |
| Sniffer Dog | 2013 | | 12 Ermine scats (probable) over 225 km; number of individuals unknown | B. Wijdeven unpubl. data 2014 |
| Sniffer Dog | 2014 | | 4-6 Ermine scats (probable) over 114 km; number of individuals unknown | B. Wijdeven unpubl. data 2014 |

'Trap nights' refers to number of traps multiplied by number of days/nights they were employed.

**Table 2. Locations of cameras used to locate Haida Ermine in 2013 and 2014, corrected for effort. Cameras detected Haida Ermine at three locations but specific locations are omitted. (Source: B. Wijdeven unpubl. data 2014).**

| Location | Camera Nights (# cameras x # nights) |
|---|---|
| Crush Creek - Highway 16 | 84 |
| SPCA - Highway 16 | 10 |
| Misty Meadows – Tlell | 24 |
| Branch 311 (QC Mainline) | 58 |
| QC Mainline - various locations | 822 |
| QC Mainline - various locations | 168 |
| QC Mainline - various locations | 84 |
| QC Mainline - km 17 | 72 |
| Honna Creek | 120 |
| Tow Hill Ecological Reserve | 22 |
| Chinikundl Road | 86 |
| Queen Charlotte – Highway | 28 |
| Queen Charlotte – Highway | 18 |
| Spirit Lake Trail | 26 |
| Total | 1622 |

The population decline is believed to have occurred around the 1950s. Although trapping effort is unknown, of 161 observations made by the public, the proportion derived from trapping was higher from 1920 to 1950 (n = 12; 34%), than after 1950 (n = 13, 10%) (Reid *et al.* 2000). An intense mammal survey during 1960 - 1961 obtained 1136 mammal specimens, ranging in size from Black Bear to Dusky Shrew from 39 islands, but did not record Haida Ermine (Foster 1965). The apparent declines corresponded with an increase in Pacific Marten populations and the introduction of Red Squirrel and Raccoon (see **Interspecific Interactions**).

The lack of new records in re-surveyed areas may mean extirpation or the species persists but was not detected by sampling. Survey effort has been intense within the area of concentrated records and greater than the effort undertaken previously when records were more common. Overall, a historical decline seems evident. Threats vary in intensity but are similar across the known range and a decline in habitat quality and population is inferred (see **Threats and Limiting Factors**).

**Rescue Effect**

Rescue from outside the population is not possible because the presently recognized range of *haidarum* exists as one population within Canada. Even if future taxonomic work establishes that *haidarum* are also found on adjacent islands of the United States (Cook *et al.* 2006; Figure 2; see **Morphological Description**) there likely would not be any rescue because of the 80 km distance between islands.

## THREATS AND LIMITING FACTORS

The main threats identified in the 2009 recovery plan are: habitat change brought about by introduced species (High Impact Threat level); small range and low abundance (High Impact); predation by native predators (Medium Impact); competition for food (Medium Impact); trapping (Medium); and forest harvesting (Low Impact) (Recovery 2009). There are believed to be three main threats to the Haida Ermine, and their effects may be cumulative. These threats are: 1) vegetation changes (specifically loss of understory cover) through browsing by introduced Deer that has reduced cover for Haida Ermine from predators, and probably has reduced numbers of avian and mammalian prey items; 2) interspecific competition and intraguild predation by an increased population of Pacific Marten; and 3) mortality from accidental trapping during Pacific Marten harvesting. Evidence is circumstantial and no inductive studies have been conducted.

The overall threat score determined from the threats calculator for the Haida Ermine was from "Medium to Low Impact" (Appendix 1). A number of the threats could be significant to Haida Ermine but were scored as "unknown impact" because of a lack of data.

**Medium – Low Threat Impact**

Natural System Modification (IUCN 7.3)

The impact of Deer on forest structure is documented in **Habitat Trends**. Deer browsing (natural system modification, other ecosystem modification) scored a medium-low impact in the threats calculator (Appendix 1). Deer have reduced vegetative cover used by Haida Ermine for concealment from predation, and this likely has indirectly led to declines in avian, invertebrate, and perhaps small mammals as food for Haida Ermine.

**Low Threat Impact**

Hunting and Collecting (IUCN 5.1)

Trapping of Haida Ermine was banned in 1985 but Haida Ermine are accidentally killed during Pacific Marten trapping. Rates of accidental mortality of Haida Ermine are unknown because voluntary reporting rates are unknown. Twenty-five Haida Ermine (15% of 162 new records obtained by public interviews) had been trapped and not reported, with four of those records occurring after the trap ban (Reid *et al.* 2000; Edie 2001). In 2004, several interviewed trappers thought that the by-catch was minimal (Parks Canada Agency 2011). The introduction of humane-certified Pacific Marten traps in 2007 coincided with deaths of five Haida Ermine, suggesting mortality from trapping is ongoing and a potentially increasing threat (Parks Canada Agency 2011). Pacific Marten trapping is permitted in provincial protected areas, and by First Nations in national protected areas. In Gwaii Haanas National Park Reserve, 12 licensed trap lines are held by Haida, though none are actively trapped at this time. These lines were in existence prior to the establishment of Gwaii Haanas and new trap line licences will not be issued within the boundaries of Gwaii Haanas (Argument pers. comm. 2014). Overall, the severity of the threat is difficult to determine. The total range of Haida Ermine exposed to consistent trapping may be small (e.g. 5% of EOO; Wijdeven pers. comm. 2014) but most trapping occurs in the same area as the concentration of records for Haida Ermine, and, if Haida Ermine populations are as low as believed, even low mortality could be significant. The threats calculator exercise scored the threat as low, mainly because of the small percentage of range being trapped. However, there is concern that Haida Ermine are at risk if the intensity of Pacific Marten trapping increases; in 2012 - 2013, 5 Haida Ermine were trapped by one trapper (Cober unpubl. data).

Rat eradication programs have occurred on several islands in Haida Gwaii as part of a plan to increase the viability of nesting seabirds. The islands include Langara, Lucy, and Cox islands in the north, and St. James Island in the south, with plans to continue eradication on 10 other islands (Golumbia 2000), including Bischof, Arichika, Murchison, and Faraday islands (Parks Canada Agency 2012). Poison is used to eradicate the rats, which raises concerns about potential mortality of Haida Ermine that may consume the bait, or scavenge on poisoned animals. It is believed Haida Ermine have not been affected because the islands are far from the known range, they contain low prey populations of Mice and Shrews, and Haida Ermine were not recorded during extensive camera surveys conducted prior to rat eradication (Bergman 2012; Parks Canada Agency 2012). The threat to Haida Ermine from the present rat eradication program is considered to be low.

**Unknown Threat**

Logging and Wood Harvesting (IUCN 5.3)

The impact of logging is unknown but believed to be minimal; logging affects approximately 25% of the CWHwh1 forests on Haida Gwaii (Park Canada Agency 2011) and Haida Ermine do not appear to avoid harvested areas. However, extensive browsing by Deer on logged areas could reduce vegetative cover in cutblocks and render Haida Ermine more vulnerable to predation (Parks Canada Agency 2011).

Problematic Native Species (IUCN 8.2)

The impact of problematic native species on Haida Ermine is documented in **Interspecific Interactions**. There is evidence to suggest that Pacific Marten numbers have increased dramatically on Haida Gwaii, and an impact to Haida Ermine is inferred. Haida Ermine moult to white in winter but snow is absent from much of the lower elevations of their range (Banner *et al.* 2014) and the Ermine could be more vulnerable to predation. While Pacific Marten can certainly kill Haida Ermine, and may do so opportunistically, it is uncertain that direct predation by Pacific Marten limits Haida Ermine. It seems more likely that competition between increasing Pacific Marten populations and Haida Ermine for the limited food supply on Haida Gwaii is a causal factor in putative declines.

Climate Change (IUCN 11)

There is no direct evidence that climate change has impacted the Haida Ermine and so its impact was scored as unknown. There is a possibility that that warmer, wetter springs (Doyle 2008) may influence the timing or amount of seed or fruit crops that provide food for Haida Ermine prey species. Although data on impact on Haida Ermine are lacking, other predators of small mammals on Haida Gwaii, such as Goshawk, have experienced breeding failure over an extended period (Doyle 2008).

**Number of Locations**

The number of locations is unknown but would likely be 'many' because the threats vary in intensity across the range; there are variations in Pacific Marten trapping effort and browsing intensity by Deer, and changes in prey availability and Pacific Marten abundance exist within all four islands where Haida Ermine have been recorded.

## PROTECTION, STATUS AND RANKS

### Legal Protection and Status / Non-Legal Status and Ranks

Although the global status for Ermine is G5 (secure), the global status for Haida Ermine is G5T2 (imperilled; NatureServe 2014; last assessed in 1996). Haida Ermine has a national rank of N2 (nationally imperilled). Based on its small population size and continued decline it was uplisted from Special Concern to Threatened by COSEWIC (Edie 2001). The Haida Ermine is ranked as S2 (imperilled) provincially. It is also on the provincial Red List (meaning it is threatened / endangered within British Columbia).

### Habitat Protection and Ownership

Approximately 52% of the land area of Haida Gwaii is currently protected from forest harvest and mining by federal or provincial designation (Banner *et al.* 2014). For example, Gwaii Haanas National Park Reserve and Haida Heritage Site (15% of Haida Gwaii) are protected by Parks Canada Agency under the *Canada National Parks Act*. However, it is difficult to determine the value of these sites because they have only a single Haida Ermine record, on Burnaby Island (BCCDC 2010). Various other sites are provincially designated, such as Naikoon Provincial Park, Vladimir Krajina Ecological Reserve, and 11 new conservancies. Other habitat suitable for Haida Ermine may occur in Haida cultural areas or wildlife areas established for several forest-nesting bird species. Outside protected areas, Ecosystem Based Management (EBM) is being carried out for logging practices and to protect riparian areas through the Gwaii Strategies Land Use Agreement (SLUA).

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## BIOGRAPHICAL SUMMARY OF REPORT WRITER

Dr. David Anthony Kirk is a consulting research ecologist and has worked for 25 years with the federal and provincial governments of Canada as well as non-government conservation organizations. David has written and/or co-authored more than 35 scientific papers and book chapters in the last 20 years, including 26 COSEWIC status reports and updates, as well as 9 draft recovery plans, 6 action plans and 9 management plans for species at risk, and a draft, multi-species action plan for grasslands in southeastern Saskatchewan.

## COLLECTIONS EXAMINED

No collections were examined during the preparation of this COSEWIC status report.

## Appendix 1: Threat Calculator

| | |
|---|---|
| **Species** | *Mustela erminea haidarum* |
| **Date:** | 12/02/2014 |
| **Assessor(s):** | David Kirk (report writer), Graham Forbes (TM SSC Co-chair), Dave Fraser (BC), Patrick Nantel (Parks), Berry Wijdeven (Recovery Team Chair), Louise Waterhouse (Recovery Team) |

| **Overall Threat Impact Calculation Help:** | | **Level 1 Threat Impact Counts** | |
|---|---|---|---|
| **Threat Impact** | | **high range** | **low range** |
| A | Very High | 0 | 0 |
| B | High | 0 | 0 |
| C | Medium | 1 | 0 |
| D | Low | 1 | 2 |
| **Calculated Overall Threat Impact:** | | Medium | Low |

| | |
|---|---|
| **Assigned Overall Threat Impact:** | |
| **Impact Adjustment Reasons:** | |
| **Overall Threat Comments** | Generation time is low; 3 years max. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | |
| 1.1 | Housing & urban areas | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | There is evidence of domestic cat kills in urban areas, but impact is negligible. Minor threat. |
| 1.2 | Commercial & industrial areas | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | |
| 1.3 | Tourism & recreation areas | | | | | | Not an issue |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | Not an issue |
| 2.2 | Wood & pulp plantations | | | | | | Not an issue |
| 2.3 | Livestock farming & ranching | | | | | | Not an issue |
| 2.4 | Marine & freshwater aquaculture | | | | | | Not an issue |
| 3 | Energy production & mining | | Not a Threat | Negligible (<1%) | Neutral or Potential Benefit | High (Continuing) | |
| 3.1 | Oil & gas drilling | | | | | | Not an issue |
| 3.2 | Mining & quarrying | | Not a Threat | Negligible (<1%) | Neutral or Potential Benefit | High (Continuing) | There are a couple of quarries, but not an issue; Ermines use rock piles |
| 3.3 | Renewable energy | | | | | | Not an issue |
| 4 | Transportation & service corridors | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | No railroads and only 1 major highway. There are roadkills, but likely negligible. Less than 1% of the population would cross roads and most would make it across; there are only 1-2 confirmed kills. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 4.2 | Utility & service lines | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | Threat is even smaller than 4.1. |
| 4.3 | Shipping lanes | | | | | | Not an issue |
| 4.4 | Flight paths | | | | | | Not an issue |
| 5 | Biological resource use | D | Low | Small (1-10%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | D | Low | Small (1-10%) | Moderate - Slight (1-30%) | High (Continuing) | What portion of the population is subject to trapping/hunting?<br>* hunting = ZERO<br>* trapping = supposed to be zero, but there are bycatch<br><br>What portion would not be exposed?<br>* 95% would not be exposed; limited trapping area<br>* SCOPE should be small<br><br>What population decline would be from trapping?<br>* records show that 4-6 dead Ermines were found in the same trap area<br>* trapping is infrequent but could be more significant because species numbers are low<br>* trapper report seeing more Ermine<br>More subject to bycatch<br>* of the population affected, SEVERITY would be in the upper end of moderate-slight (between 10-30%) |
| 5.2 | Gathering terrestrial plants | | | | | | Not an issue |
| 5.3 | Logging & wood harvesting | | Unknown | Small (1-10%) | Unknown | High (Continuing) | What percentage will experience logging/harvesting?<br>* 1-10%<br>Is logging bad for them? Do we anticipate decline?<br>* We don't know, but Ermines are generalists; evidence they will use cutover areas<br>SEVERITY = unknown<br>* could have an impact over the short-term, but probably not long term unless deer populations are increased further because of additional browse production |
| 5.4 | Fishing & harvesting aquatic resources | | | | | | Not an issue |
| 6 | Human intrusions & disturbance | | | | | | Unknown |
| 7 | Natural system modifications | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | | No fire suppression – fire events are rare, and haven't had a fire in a long time<br><br>How much of Queen Charlotte Island do you expect to burn in the next 10 yrs?<br>* 3 fires in last year; covered 3 hectares |
| 7.2 | Dams & water management/use | | | | | | Not an issue |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7.3 | Other ecosystem modifications | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | Impact not explicitly known but deer remove the forest understory and removes ability for Ermine to hide from predators<br>* there are few islands that haven't been affected<br>*there has been research that birds have been affected; but it's pretty hard to estimate for mammals; 40-60% decline of birds affected<br><br>Small mammals limited to deer mice and shrews<br>* there is limited stomach analysis but there have been birds in the stomach<br><br>SEVERITY: more comfortable with moderate-slight (11-30%) |
| 8 | Invasive & other problematic species & genes | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 8.1 | Invasive non-native/alien species | | Negligible | Negligible (<1%) | Slight (1-10%) | High (Continuing) | Ermine are attracted to human population for chicken coops/garages but urban sites are fairly small and therefore, percentage wise, not a big impact. Less than 1%.<br><br>Cats<br>* There have been 2 cat kills in town, probably more in other places<br>Raccoons and rats<br>* unknown impact but rats have decreased prey items of Haida Ermine |
| 8.2 | Problematic native species | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Pacific Marten<br>* Pacific Marten are important force competing with Ermine for food<br>* Pacific Marten will eat Ermine<br>* local knowledge indicates that Pacific Marten has increased (due to less trapping) and they are filling the niche<br><br>Aerial predators<br>* Goshawk, but not really a threat because of its rarity<br><br>Anticipating a continuing decline of Ermine (3-30%) in the next 10 years but uncertain |
| 8.3 | Introduced genetic material | | | | | | Not an issue |
| 9 | Pollution | | | | | | Not an issue |
| 10 | Geological events | | Not a Threat | Negligible (<1%) | Neutral or Potential Benefit | High (Continuing) | |
| 10.1 | Volcanoes | | | | | | Volcanoes have been inactive for thousands of years. |
| 10.2 | Earthquakes/tsunamis | | | | | | Earthquakes and tsunamis are possible. Area affected would be large, but impact would be small if most of population is on eastern region |
| 10.3 | Avalanches/landslides | | Not a Threat | Negligible (<1%) | Neutral or Potential Benefit | High (Continuing) | Areas where landslides could occur is small. Negligible. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 11 | Climate change & severe weather | | | | | | Haida Gwaii is getting wetter, but in terms of the next 10 years, this impact would be negligible - more of a long term concern for food supply. |